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FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES — WORLDWIDE
JANUARY 7, 1991

RETHINKING SEAGATE'S STRATEGY

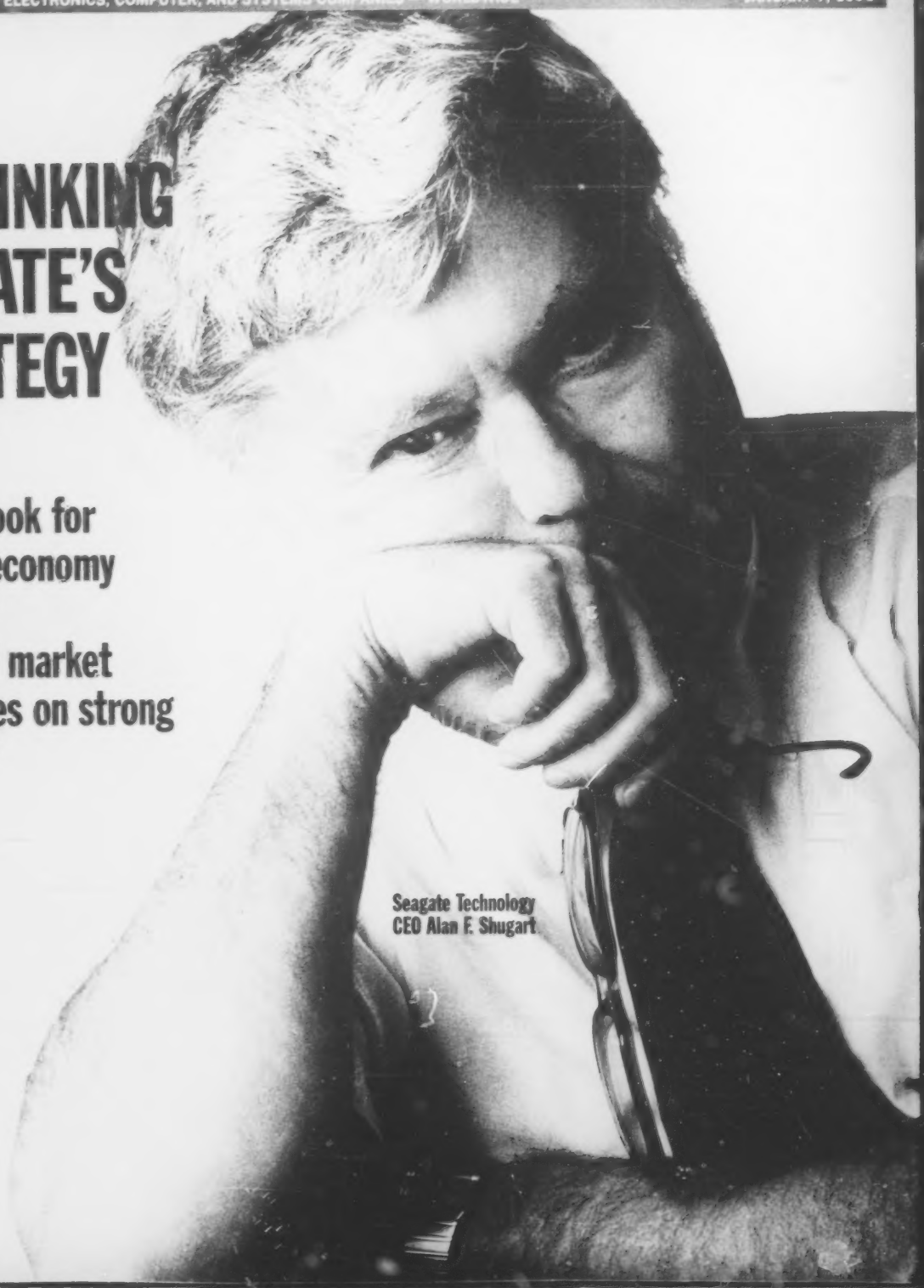
PAGE 28

Outlook for the economy

PAGE 44

FDDI market comes on strong

PAGE 72



Seagate Technology CEO Alan F. Shugart

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 17, NO. 1 JANUARY 7, 1991

PAGE 28 CEO Alan F. Shugart: "You have to control the technologies"

Cover: Jeffrey Dodge Rogers

COVER STORY/SEAGATE

28 Seagate's strategy for catching its competitors

Volume manufacturing and in-house component manufacture were the weapons Seagate Technology used to enter and dominate segments of the disk-drive market pioneered by smaller companies. But now, being a technology follower has become a serious liability. CEO Alan Shugart has a radical plan to make Seagate a leader in the race to market

UPDATE

13 Business Trends
Would-be American HDTV vendors go digital, while Europe suffers an HDTV setback; recession jitters felt at Comdex; Philips finds company in fiscal misery; U.K. invites telephone competition; voice activation goes mobile; Stratus's strategy in Asia; licensing deal boosts cellular standard

23 Companies to watch
Overcoming PALs' speed, power limitations; putting punch in small chip packages; using software to test manufacturing process

25 Commentary/PC Insight
Laptop computers have changed the personal-computer business forever. Will Fastie finds one segment of the market where the change is going down hard

COVER STORY/SEAGATE

28 Seagate's strategy for catching its competitors
Giant Seagate must learn to run after walking for so many years. Seagate's new 2.5-inch drives, for example, won't begin shipping until after competing products hit the market. Further, it remains to be seen how successful the company will be in nailing down lucrative OEM design wins

30 Seagate faces foes on all form-factor, capacity fronts
At home and abroad, Seagate must deal with competition from a host of disk-drive manufacturers. Here's how the competition stacks up

32 Seagate feels pressure for quality
Responding to market pressure for product quality and reliability, Seagate is implementing six-sigma quality control throughout its vertically integrated manufacturing operations

STRATEGIES

39 The minnow that swallowed the whale
The story of Vishay Intertechnology shows how a small player in a slow-moving market can buy its way to world leadership as long as its acquisitions make good business sense

OUTLOOK

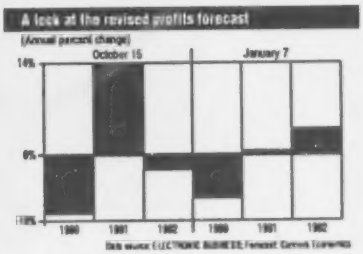
44 A stalled economy batters electronics growth
Predicting the length and severity of the economic downturn is a complex task, with many variables in play. ELECTRONIC BUSINESS anticipates that most segments of the electronics industry will see solid single-digit growth through 1991

PAGE 61 Hana Group's Richard Han: In Thailand job market, "Everyone's stealing from each other"

PAGE 13 Cellular sales go up as cost goes down

PAGE 39 Vishay CEO Zandman chose to grow by acquisition rather than product-development

PAGE 55 Anamartic CEO Peter Cavill's goal: one-quarter of the market by 1994



PAGE 93 Economists revise profits forecast downward

EUROPE BUSINESS

55 **Anamartic hopes to revive wafer-scale integration**
In Cambridge, England, start-up Anamartic Ltd. has set itself a goal that has daunted many a company during the '80s: to make magnetic-disk storage obsolete by developing a high-speed memory peripheral based on wafer-scale integration

ASIA/PACIFIC BUSINESS

61 **Can booming Thailand survive its success?**
Faced with staggering infrastructure problems, a shallow economy, and a chronic shortage of engineers, Thailand's economy may be spinning out of control. Yet few expatriate managers regret cashing in on the country's electronics boom

MARKET PERSPECTIVES

67 **DSP is giving all the right signals**
As the enabling technology behind trendy new products, digital signal processors could enjoy compounded annual growth of nearly 30%, while the rest of the semiconductor industry settles for a growth rate half that large

72 **FDDI comes on strong as networks run out of room**
Makers of computer systems join the ranks of companies offering products based on the fiber distributed-data interface. Their participation gives credence to forecasts of a fast-growing FDDI market

BUSINESS BAROMETER

93 **Recession**
Fallout from the Gulf repaints the profit picture

94 **Leading Indicator**
The Indicator drops a point

DEPARTMENTS

5 **Inside Business**

9 **Letters**

85 **My View**
Changing the way we sell products

79 **Advertiser Index**

96 **Viewpoint**
Just what is an electronics company?

COMPANIES IN THIS ISSUE

78 **An index of the companies covered in this issue**

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Making our issues "reader-friendly"

The claim "transparent to the user" is one of those claims advanced—*ad nauseam* and often with scant justification—by software developers pushing their products. This poetic phrase can be translated into everyday English: "You don't have to know how it works or watch weird symbols flash before your eyes; just enter simple commands and get the information you need."

Ever-vigilant copy editor Elaine Cummings

Magazines don't advertise their "user transparency" for the same reason software companies don't brag that their products won't crash your computer system. It is assumed that this will be the case, that it is a user's (reader's) basic right. A magazine that asks its readers to struggle with clumsy syntax or to bridge gaps in the information forfeits its right to their attention. That doesn't mean "transparency to the reader" is easy to achieve, especially in a publication that combines business and technology. Just ask Elaine Cummings, copy editor and de facto dean of user transparency at ELECTRONIC BUSINESS. "The challenge is making sure that it is grammatically correct, technically sound, and reads like Hemingway," she says.

Elaine is a recent, welcome addition to our staff, arriving with a background in both teaching and business publishing. After sizing us up, she quickly drafted a style guide to ensure that our spelling, punctuation, sentence structure, and nomenclature remain clear and consistent. Every story is the object of her ceaseless vigilance, and neither gratuitous business jargon nor acronym-clotted technical obscurity is permitted to escape her computer terminal.

This particular issue of ELECTRONIC BUSINESS has been a test of that vigilance, ranging as it does from the technological high ground to the clamor of the marketplace. Elaine has had to deal simultaneously with stories on the future uses of digital signal processing, the emerging standards for fiber distributed-data interface, and the new marketing strategy of giant disk-drive manufacturer Seagate Technology.

Perhaps the biggest challenge in this issue has been our economic outlook ("A stalled economy batters electronics growth"). Managing editor Bruce Rayner interviewed economists across the opinion spectrum to produce best-case, worst-case, and consensus forecasts. An accompanying array of charts and graphs provides a quick grasp of where the experts believe various sectors of the electronics industry are headed.

One thing transparent to almost all users of our economy is that tough times lie ahead. Just how tough? Read on.

JOHN PARKER, section editor

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tion, the boom times are not over. More than 125,000 made the annual pilgrimage to Las Vegas for Comdex, exceeding the 1989 turnout of 118,000. The 1,850 exhibiting companies, up 7% from 1989, occupied some 2.2 million square feet of floor space, an 18% increase from one year earlier.

Nevertheless, apprehension was evident at the show about the state of the economy and the query "How's business?" was more than a friendly greeting.

Fujitsu Microelectronics Inc., for example, has been girding for an economic slowdown since early 1989 and has been keeping a tight rein on its expenses, according to Rich Christopher, senior vice president and general manager of the company's integrated circuits division in San Jose. But Christopher said the company has seen little confirmation of a downturn beyond slower sales in the second quarter of 1990. And the executive pointed to a recently opened semiconductor plant in Japan as evidence that the company has decided to continue purchasing capital equipment.

Peter M. Craig, vice president of Rainbow Technologies Inc., an Irvine, Calif., supplier of computer security products, said he talks to his top 100 customers on a regular basis, and most are waiting for the other economic shoe to drop. "It seems like [the economy] is doing better than everybody had feared," he said. "But there are a lot of yellow flags flying out there."

"Business has not been robust," acknowledged David P. Berry, new product development manager for Maxell Corp. of America. He says that shipments of floppy disks from all vendors were "down dramatically," in 1990 over 1989. As floppy disks go, he reasons, so goes the computer industry.

Comdex also reflected the current fortunes—or misfortunes—of individual companies. Traffic was light at the booth operated by ailing Unisys Corp. while a speaker at Wang Laboratories Inc.'s booth preached to nearly empty rows of chairs.

In contrast was Microsoft Corp. whose booth was constantly packed with showgoers checking out applications for the company's new Windows 3.0 graphical user environment.

RICK WHITING

EUROPE

Philips has company in fiscal misery

POOR PHILIPS. For months it flooded stockholders and the media with the latest bulletins on its restructuring until discovering in November that—whoops!—its 1990 losses would be double its earlier estimates. This, just months after agreeing to pay $9.3 million to settle a case brought by U.S. investors over Philips NV's failure to notify them of its fiscal woes in the first place.

The revised warning pegged the net loss for 1990 at $2.4 billion, although optimistically, Philips predicts profitability in 1991. Earlier, the company announced it would lay off up to 20% of its global workforce of 285,700.

One of its first businesses to restructure is semiconductors, which was separated from the Components Division as of the first of January. The new semiconductor products division is led by Heinz Hagmeister, formerly head of the IC business unit. Already there is talk about a possible joint venture with Matsushita, which cooperates with Philips on a lighting product joint venture in Japan. Matsushita could fill the capacity at an underutilized chip plant in Nijmegen since Philips left the SRAM business.

Philips isn't the only European company in serious trouble. In November Ing. C. Olivetti & Co. announced plans to slash 7,000 workers from its global force of 55,000. The Italian giant's sales were running ahead of last year's, and unlike Philips, the company is still profitable. Olivetti was hit by the downturn in European computer sales and the sharp appreciation of the Italian lira against the dollar. Sales growth for personal computers in Europe slumped to less than 5% in the third quarter of 1990.

Facing losses as high as $800 million in 1990, Groupe Bull is aiming for profitability in 1992 by sweeping away most jobs not directly related to R&D, manufacturing, sales, and service. It announced layoffs of 5,000 workers, including 2,000 non-manufacturing jobs in the United States. About 1,000 jobs from its Bull HN headquarters in Massachusetts will be cut. Bull is closing 7 of its 13 plants by 1992.

At the same time, Bull increased its R&D spending for its new Zenith Data Systems unit by 25%, boosted by French government subsidies. It also is shifting focus to software-application packages and computer services. The company is looking for partners in non-core businesses, such as peripherals, which it spun off in the hope of attracting equity.

BARBARA BERKMAN

UNITED KINGDOM

U.K. opens telephone services to competition

U.S. COMPANIES will be able to sell their telephone services in Britain because of a new government proposal to liberate the telecommunications services market.

The major beneficiaries are Baby Bells that took shares in British television cable companies, which now can sell basic telephone services, as can the operators of cellular networks, satellites, and private communication networks.

A stalled economy batters electronics growth

Are we in a recession? If so, how bad will it be? ELECTRONIC BUSINESS *takes a critical look across the spectrum of economists' views*

BY BRUCE C. P. RAYNER

One thing is for sure: The U.S. economy is now at the end of the longest peacetime expansion—roughly eight years—since the government began recording business-cycle fluctuations during the 1850s. Citing shaken consumer confidence and the scuttling of many business investment plans for 1991, many economists now believe that the nation has entered a recession. A recession is usually defined as two or more consecutive quarters of negative GNP growth.

Business leaders today are more concerned with estimating the length and severity of the downturn. But that is not an easy prediction to make since there are many variables to consider, some relatively clear cut, and others undetermined. At least three complex factors could dramatically impact the nation's economic health:

- **Rising oil prices.** A war in the Middle East would threaten oil supplies and play havoc with energy prices, intensifying inflation and slowing the economy even more. If a full-scale war in the Persian Gulf breaks out, a recession would last at least four quarters and maybe longer, say many economists;
- **An over-leveraged banking system.** Banks are being pinched by falling real estate prices, intensified re-regulation, and increases in bad credit risks. The result is a general perception by banks everywhere that lending should be curtailed. Add to that the prospects of additional bank failures;
- **The federal budget deficit.** If European and Japanese banks withdraw their money from U.S. capital markets in order to prop up their own slowing economies, the U.S. government would be forced to raise interest rates to attract the funds back, further slowing an economic recovery in the United States.

The role these factors would play in slowing economic growth is far from certain. In this report, ELECTRONIC BUSINESS presents a range of opinions and scenarios from the optimists, the pessimists, and the consensus. In general, the industrial and business economists tend to fall into the optimist category, while bank and financial economists take a more pessimistic view.

Where does ELECTRONIC BUSINESS stand? We believe that the most realistic forecast for 1991 is somewhere on the optimistic side of the consensus view. Barring a major Middle East conflict, we believe the national economic recession will be relatively short—no longer than two or three quarters.

On an industry level, we anticipate that most segments of the electronics industry will see solid single-digit growth through 1991. □

THE CONSENSUS

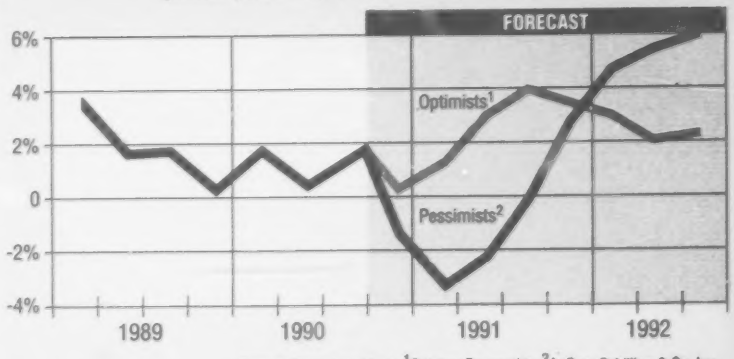
For the first time since June 1982, the Nov. 10 issue of the *Blue Chip Economic Indicators* newsletter printed its headline in red. That means the majority of the 55 economists surveyed now believe that real GNP growth has dropped below zero.

In all, 80% of the Blue Chip panel members say a recession started in the fourth quarter of 1990 but will last only about two or three quarters and will be relatively mild. GNP growth in 1991 will average around 0.5%, according to the Blue Chip consensus.

Consensus reports all predict more or less the same thing: slow GNP growth in the first half of 1991 coupled with sluggish consumer spending and a mild slowdown in business activity. A mid-year pickup in economic activity is expected as oil prices start to fall and consumer and business confidence returns. Industrial production will be flat next

GNP growth

(annual percentage change on a quarterly basis)



Source: Commerce Dept., [1]Cahners Economics, [2]A. Gary Schilling & Co. Inc.

quarter and post a 2.2% growth in the third quarter and 3.2% growth in the fourth quarter.

On the positive side of the economic picture is the trade sector. Although the Canadian and the U.K. economies are sluggish, other countries are expected to maintain reasonable growth through the year. That is good news for U.S. exports, which will continue to show signs of strength while imports will grow more slowly.

In a recent consensus of 71 macroeconomic forecasters, the National Association of Business Economists (NABE) projected the 1991 real trade balance in the United States to be less severe than previously expected due to a lower dollar and weak domestic demand. Last May, NABE forecast the 1991 trade deficit at $40 billion but has since lowered its estimate to $31 billion.

Chris Probyn, associate director of forecasting at Data Resources Inc., agrees that the export sector will remain one of the bright spots on the economic horizon. "The lower value of the dollar is the reason for the mildness of the recession," he says. GNP growth will be a negative 2.1% this quarter and won't turn positive until the third quarter, according to DRI.

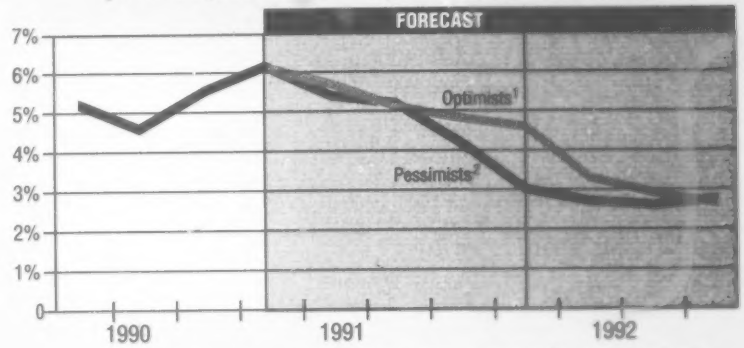
Like most consensus-minded economists, Probyn assumes that there will be no war in the Middle East. Oil prices will start their descent this quarter and will be back down in the $20-a-barrel range by mid-1992. The recent decline in consumer confidence was largely a result of the spike in oil prices, Probyn says. As prices come down, consumer spending is expected to rebound.

Maybe, maybe not. The consumer sentiment index, a broad measure of consumer opinion compiled by the University of Michigan, fell 24.3 points from July to 63.9 in October, the steepest three-month fall in 44 years. The value is still above the all-time low of 51.7 recorded in May 1980, but the index is expected to fall even further than its current level.

The consensus view on inflation, as measured by the consumer price index (CPI), is that it will moderate from around 6% in late 1990 to below 5% by the end of the year. This decline is largely the result of the drop in oil prices. DRI expects the CPI to fall to below 3% by the end of the year. The Blue Chip consensus puts the fourth quarter CPI figure at 4.4%.

Inflation rates

(consumer price index, quarterly growth rates from year ago)



Source: Bureau of Labor Statistics, [1]Cahners Economics, [2]A. Gary Schilling & Co. Inc.

On the industrial front, many economists believe that business cycles in the 1990s will be much more muted than in the 1970s and early 1980s, largely because of better inventory management. An exception is the retail sector, where an inventory overhang is still too high. Some economists expect a sluggish retail sector through much of the year. Everett Erhlich, vice president of economic and financial planning at Unisys Corp., believes both the financial and retail sectors are destined for further restructuring.

There are advantages and disadvantages to this muted business cycle. On the plus side, there are no violent gyrations in employment and business activity. Management has much better visibility of slowdowns and can adjust production accordingly before crises develop. On the negative side, softer business cycles imply that slow-growth periods will be more protracted than in the past. That includes 1991 growth. The Blue Chip consensus puts industrial production growth for the year at a meager annual rate of 0.6%, down from a 1.1% 1990 estimate.

As for policy initiatives, most of the consensus economists believe the Federal Reserve Board has done a good job of managing monetary policy. The challenge now is whether the Fed can stay the course. The consensus believes that the Fed should loosen the reins on monetary policy by dropping the discount rate still further and easing bank reserves.

As far as the technology sector is concerned, most industry economists believe that the days of divergent growth paths between the economy and the technology sector are gone. There are indicators that business investment in computers and telecommunications equipment are determined by macroeconomic trends. The good news is that the business investment sector will, for the most part, not suffer severely. □

THE OPTIMISTS

Optimistic economists believe the recession is either nonexistent or will be so short as to be not worth worrying about. The fourth quarter of 1990 may have seen negative GNP growth, they say, but growth will pick up in 1991 and may average 2% for the year. Optimists believe there are no fundamental weaknesses in the economy.

These economists say that the violent swings in the business cycle are a thing of the past. "The recessions of the 1990s will be so different from those of the 1970s and 1980s that the same word should not be used to describe them," says Jim Haughey, vice president of economics and research with Cahners Economics and a self-professed optimist.

Haughey points to three fundamental shifts in the business environment that mark the end of the traditional business cycle: a freer and more open international trading environment; the financial deregulation of the 1980s that allows capital to

flow more readily into non-mortgage investments; and more sophisticated inventory management.

While the optimists do not forecast a boom—they predict growth through the early 1990s to average between 2% and 3%—they do not see a bust either. Manufacturing capacity utilization is running in the low 80% range, close to where it was in 1982 when the expansion began. That means utilization is still high enough to maintain a healthy level of business investment. Cahners Economics predicts business fixed investment will post annual growth rates of 2% in 1991 and 4.3% in 1992.

Brian Wesbury, vice president and economist with The Chicago Corp., points to strength in both the supply and demand sides of the economy as a basis for his 1991 GNP growth forecast of 2%. On the supply side, Wesbury points to continued healthy gains in productivity rates. While the productivity growth rate is down from a mid-1980s high of 1.75%, it is still hovering around 1%, he says. Productivity gains lead to higher output and higher GNP.

On the demand side, Wesbury believes the Federal Reserve Bank's monetary policy in 1990 has been relatively expansionary. This acts as a stimulant to economic activity. As evidence he points to the drop by 0.75% of the Federal Funds' interest rate in the last year and a 10% growth in the monetary base. As a rule of thumb, the lag between monetary policy stimulation and higher economic activity is about nine months.

It is very unlikely that the economy will move in the opposite direction of monetary policy. But that doesn't mean that it could not happen this time. One thing worrying the optimists is the fact that October 1990 saw a slowing economy even though the fundamentals were in place—industrial output fell 0.8% during October while employment fell by 68,000 jobs and U.S. plant capacity utilization dropped to 81.7%.

The reason for the poor results, says Wesbury, was "psychological factors," namely falling consumer confidence. But most optimists project that prices will fall and consumer buying will resume leading to a pickup in business activity. "I am not certain how long consumer confidence can stay low," says Wesbury, "but the fundamentals are in place for strength in 1991."

Another concern is the re-regulation of the banking sector. If the banking system is stymied in its role to create investment and growth, then the economy could face problems ahead. At issue now is an attempt by Congress to increase insurance costs on deposits by 4%. The effect will be a crimping of banks' operating profits and a higher cost of borrowing money. "If our forecast is wrong," says Wesbury, "it will be because of over-regulation of the banks." □

THE PESSIMISTS

Not all pessimists are alarmists. But unlike their optimist brethren, they look at the economy and see threats rather than opportunities. For the most part they look beyond the conventional economic indicators to more basic structural issues—in this case a weakened banking sector. While they have been out of favor throughout the 1980s, they are now coming into their own. Forecasts for GNP growth in 1991 among this group of economists range from positive 0.5% to negative 3%.

"The range of uncertainty has never been greater in the post-war years," says Donald Ratajczak, director of the economic forecasting center at Georgia State University. Oil prices are the major concern at this juncture in the economic slowdown, but close behind is the problem of the financial sector's liquidity, he says. While Ratajczak expects banks to "muddle through" the slowdown, he sees a risk to economic stability should there be any bank failures. The forecasting center at Georgia State is projecting GNP growth of zero to 0.5% for 1991.

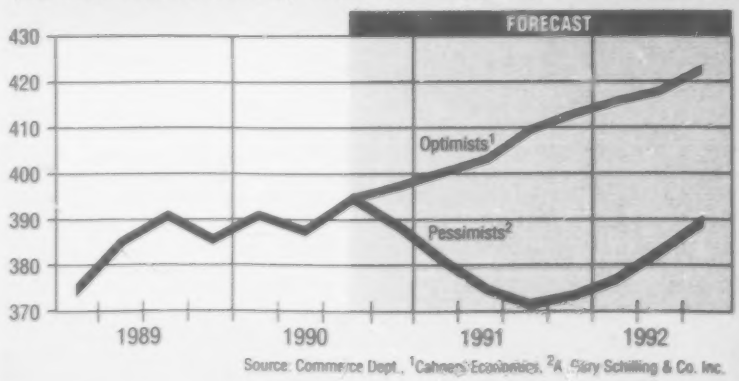
Ratajczak is an optimist of a sort compared with some pessimists. "We have probably been in a recession since late 1989," asserts Gary Schilling, economist and president of A. Gary Schilling & Co., a New York-based forecasting firm. He expects continued downward revisions to the anemic GNP numbers for much of 1990—maybe even back into 1989—and he predicts GNP growth for the year at a negative 3.0%.

Schilling's thesis is that the current U.S. economic downturn is different from others the country has experienced in that it is first and foremost a "balance sheet" recession; that is, the rise in the economy's debt burden in the 1980s—bank under-collateralized debt, an explosion of leveraged buyouts through junk bonds, rising consumer debt, and troubled Third-World debt—is out of control. But as current economic activity slows due to rising oil prices and falling consumer confidence, the recession has spread to the economy's "income statement"—the GNP accounts that include consumer spending and business investment.

The combination of the two aspects of recession could be devastating. As the economy slows, so does cash flow and the country's ability to service its debt, so a downward spiral ensues. An over-leveraged economy increases the risk of bank

Business investment

(non-residential fixed investment, producers' durable equipment, billions of 1982 dollars)



Source: Commerce Dept., [1]Cahners Economics, [2]A. Gary Schilling & Co. Inc.

failures and the increasing inability of the government to stem a tide of pessimism and panic. Pessimists like to draw parallels between the 1990s and the 1930s.

On the positive side, growth in demand for debt is dropping, says John Langum, president of Busin s Economics Inc., in Chicago. (Langum prefers the label "realist" over "pessimist.") But he points to a drop in the growth rate of debt as evidence that demand is dropping sharply. Household debt growth fell from 7.4% in 1989 to 6% in the second quarter of 1990, while non-financial business debt fell from 6.7% to 4.0% over the same period. Langum expects a negative 2% GNP growth in 1991.

While optimists point to inventory management, business investment, and the international trade sector as solid in 1991, pessimists are not so sure. Residential construction—a primary leading indicator—has failed to turn the corner after dropping at a 15.4% annual rate in the third quarter of 1990. That is the sixth quarterly decline out of seven quarters for residential construction.

Nor do the pessimists indicate much hope for growth in business investment, either. A leading indicator of business spending is corporate cash flow, which provides the incentives—profit growth—and the means—retained earnings—for capital spending, says Schilling. But for the last few years, net cash flow has been falling as the slowing economy squeezes margins. Fixed investment, while not dropping yet, is expected to contract over the next few quarters.

Pessimists agree that management's control of inventory has improved considerably but doubt whether this is sufficient to avoid sharp drops in industrial production should the economy sink into a deep recession.

And on the international front, the trade balance will show continued improvement, but not because of a growth in exports. It will be the result of fewer imports. Export growth averaged 5% in late 1990 and could well slow in 1991 as foreign economies head south—Canada, Australia, and the U.K. are already in recession and continental European countries and maybe Japan could head into a recession sometime this year, say pessimists. □

Electronics outlook: slow and steady

As with economic forecasts, electronics market forecasts tend to diverge greatly. Because ELECTRONIC BUSINESS tends to take a fairly sanguine view about the economy in 1991, this year's market forecasts reflect a fairly upbeat year ahead. While growth overall in the 1990s is expected to be slower than during the 1980s, 1991 will nonetheless see solid single-digit growth rates in most sectors.

There are no fundamental signs that demand for electronics will suffer to any great extent in the near term. Still, there is no denying that corrections are being made. The semiconductor book-to-bill ratio, on a three-month moving average basis, dipped from 1.0 in August to 0.95 in October. That means a slowdown in chip business as shipments of chips are outpacing new orders. Forecasts for chip production in 1991 range from slightly negative growth to slightly positive.

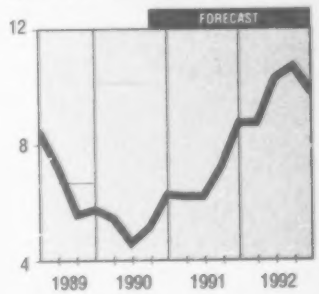
According to Cahners Economics, total electronics production, shipment, orders, and capacity bottomed out in the fourth quarter of 1990 and will post modest gains throughout the year and into 1992. The University of Michigan forecasts business investment in information-processing equipment to grow about 5% in 1991.

ELECTRONIC BUSINESS's generally positive sentiment is reflected by industry executives. "I don't see evidence of the slowdown," said Leon Machiz in mid-November. As chairman and CEO of Avnet Inc., the largest electronics distributor in the United States, and middle man for much of the electronics component industry, we believe he has a better-than-average window on demand and supply pressures. □

The U.S. Electronics Industry

Production

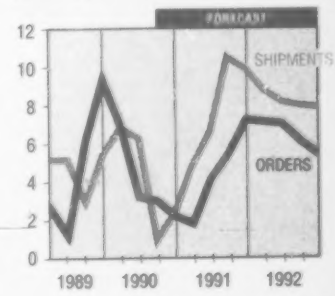
(quarterly percentage change from year ago)



Source: Federal Reserve, Cahners Economics

Shipments and orders

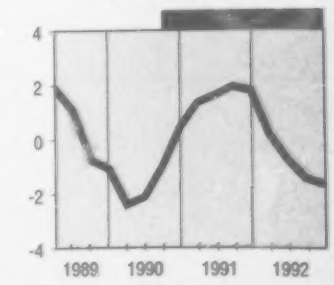
(quarterly percentage change from year ago)



Source: Department of Commerce, Cahners Economics

Industry capacity utilization

(percentage change)



Source: Federal Reserve, Cahners Economics

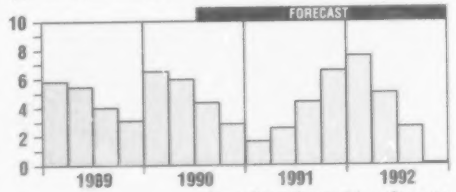
Electronics Outlook for 1991 and 1992

Electronic Components

The recession is hitting the components industry hard right now, but growth is expected to pick up later in the year. Shipments and orders growth bottomed out last quarter, and production is in the trough this quarter.

Growth in production

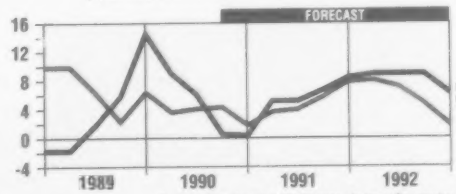
(quarterly percentage change in production index from year ago)



Source: Federal Reserve, Cahners Economics

Growth in shipments and orders

(quarterly percentage change from year ago)



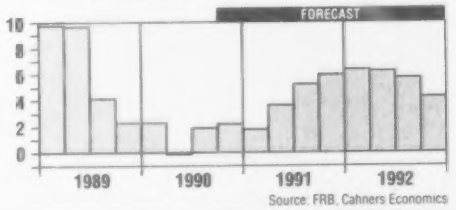
Source: Department of Commerce, Cahners Economics

Instruments and Controls

The instruments and controls market bottomed out in the fourth quarter of 1990 and will post solid growth through 1991 and into 1992. Production growth will top out at a 6.3% rate in the first quarter of next year.

Growth in production

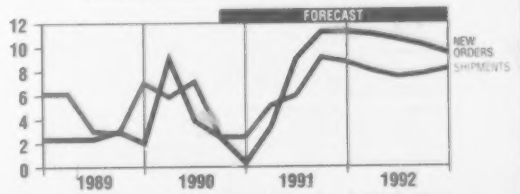
(quarterly percentage change from year ago)



Source: FRB, Cahners Economics

Growth in shipments and orders

(quarterly percentage change from year ago)



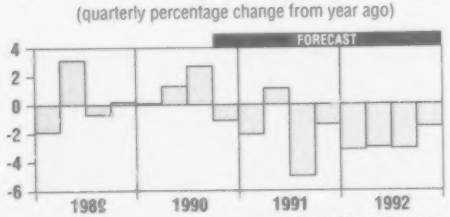
Source: Department of Commerce, Cahners Economics

Military Electronics

Despite the need for retrofitting and the trend toward higher electronics content, military electronics will see contraction throughout the decade. In 1991, shipments are expected to post negative growth.

Growth in military electronics shipments

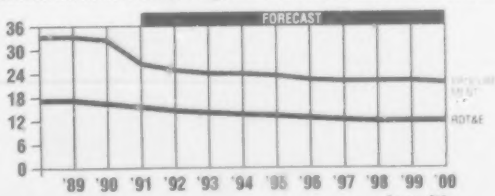
(quarterly percentage change from year ago)



Source: Cahners Economics

Defense electronics

(electronic content of defense budget in billions of constant FY 1991 dollars)



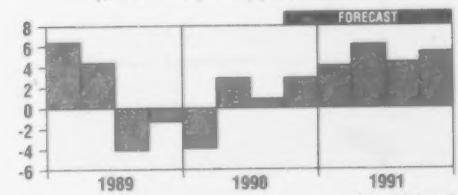
Source: EIA

Semiconductors

The experts say that business cycles in the semiconductor industry will be shorter and milder in the 1990s. Still, growth in 1991 could reach a quarterly high of 10%. As for the book-to-bill ratio, expect stability around 1.0 for most of the year.

North American semiconductor consumption

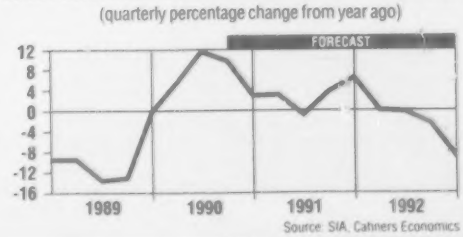
($ in billions, quarterly percentage change)



Source: Dataquest

North American semiconductor book-to-bill ratio

(quarterly percentage change from year ago)



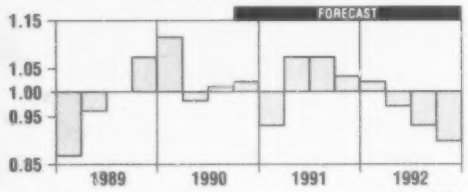
Source: SIA, Cahners Economics

Electronics Distributors

The bellwether of the electronics industry, electronics distributors will see a pretty steady book-to-bill ratio for most of 1991, with shipments and orders growth peaking in the second half of the year.

Distributors' book-to-bill ratio

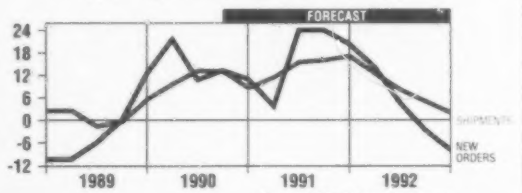
(ratio of shipments to orders)



Source: NEDA

Growth in shipments and orders

(quarterly percentage change from year ago)



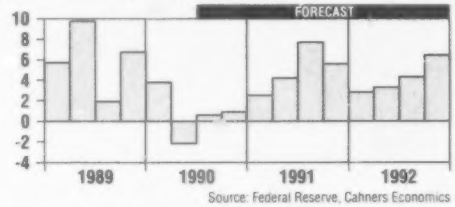
Source: NEDA, Cahners Economics

Consumer Electronics

The U.S. television and radio market can expect only slow growth in 1991. But after the contraction of 1990, any positive growth is encouraging. Orders will peak in the third quarter of the year.

Growth in production

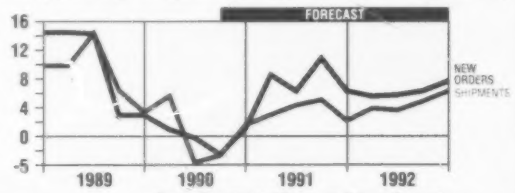
(quarterly percentage change from year ago of U.S. T.V. and radio market)



Source: Federal Reserve, Cahners Economics

Growth in shipments and orders

(quarterly percentage change from year ago of U.S. T.V. and radio market)



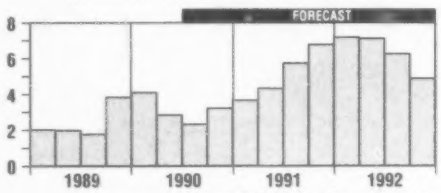
Source: Department of Commerce, Cahners Economics

Communications Equipment

After a steady decline in 1990 of order and shipments, the commercial communications equipment market will post steady growth in 1991. Production too will pick up. The market driver is primarily non-U.S. demand.

Growth in production

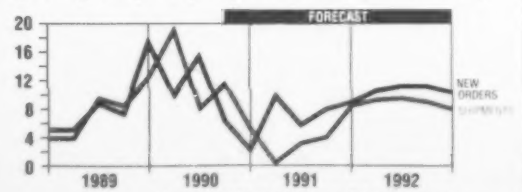
(quarterly percentage change from year ago)



Source: Federal Reserve, Cahners Economics

Growth in shipments and orders

(percentage change from year ago for non-defense communications)



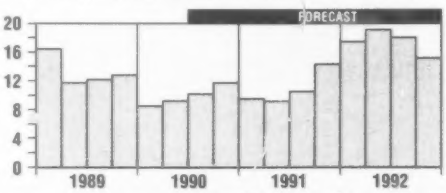
Source: Department of Commerce, Cahners Economics

Computer and Office Equipment

The computer and office-equipment market will be stable and slightly up in 1991. Activity will be strongest in the pocket, notebook, and laptop markets, with the mainframe and minicomputer markets continuing to languish.

Growth in production

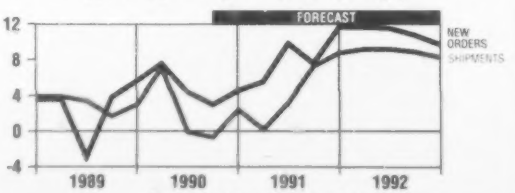
(quarterly percentage change in production index from year ago)



Source: Federal Reserve, Cahners Economics

Growth in shipments and orders

(quarterly percentage change from year ago)



Source: Department of Commerce, Cahners Economics

DSP is giving all the right signals

A range of strategies emerge as vendors try to bring digital signal processing to the masses

BY PETER BURROWS

They already are a fundamental reason for the sound clarity of your CD player, the enhanced graphics of your laser printer, and the increased functionality and speed of your modem. In a few years, digital signal processors (DSPs) could be the enabling technology behind continental digital cellular-telephone networks, multimedia computers, and such futuristic gizmos as filmless cameras, tapeless phone answering machines, and semiconductor-size electronic mufflers.

DSPs are single- or multichip devices that can be coupled with analog-to-digital converters to accept, compress, improve, store, transmit, or otherwise manipulate analog signals such as sound, light, and radar. While the rest of the semiconductor industry settles into a projected growth rate of 14.3% through 1995, DSPs are slated for 27.9% compounded annual growth during that time, creating a DSP market of $3 billion, according to market analyst Will Strauss of Forward Concepts in Tempe, Ariz.

But the DSP market is not yet ready to join the ranks of mega-volume semiconductor segments such as microprocessors or dynamic RAMs. Market growth has been constrained by formidable product complexity, a tentative customer base, and lack of vendor support. "DSP is still kind of a black art, and there are only a few hundred magicians in the world who really understand its power," says David Wong, president of Spectron Microsystems Inc. of Santa Barbara, Calif., which sells a DSP operating system called SPOX. "The secret is to make that power available to the many thousands who can make the best use of it."

That transformation is happening, slowly but surely. Vendors of programmable general-purpose DSPs—including Texas Instruments Inc., Motorola Inc., AT&T, Analog Devices Inc., and NEC—have been slugging it out since the mid-1980s to see who could provide the best development tools to make the design of DSP applications as easy as possible for customers. Strauss expects this $284 million general-purpose segment of the DSP market to grow to $1.3 billion by 1995.

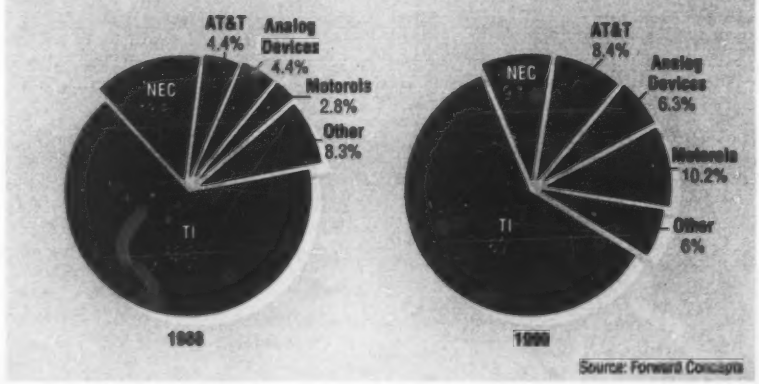
More recently, some innovative U.S. niche players and selected Japanese chip-makers have begun offering nonprogrammable plug-and-play solutions that electronics manufacturers in selected vertical markets can incorporate into high-volume products such as modems, copiers, and telephones. Forward Concepts expects this $390 million FASIC (function and algorithm-specific IC) market to grow to $1.3 billion or so by 1995.

The snowballing interest in DSP has also spurred the development of an industry infrastructure. Third-party support for DSP users by add-on applications-development board vendors and software design-tool vendors is about a $90 million business in the United States, says Strauss.

The upshot of all this activity is that electronics designers from audio to avionics are becoming more knowledgeable about DSP technology and are increasingly putting it to work. Major markets include:

- **Computing**: While Steven Jobs's use of a general-purpose DSP from Motorola in his Next workstation has been a commercial disappointment to date, insiders say that he gave momentum to a trend—almost every major computer-maker has either signed a contract to incorporate DSP technology into their systems, or they have expressed an interest to do so. Initially, this would furnish computers with the video-compression capability necessary to store memory-

DSP's big five



hogging motion-video files; later in the decade, DSPs will drive full-fledged multimedia computing. Forward Concepts projects this DSP segment to grow from $8 million in 1990 to $250 million in 1995;

- **Telecommunications**: A battle is already under way to supply the DSPs for the digital cellular-phone networks that will be installed in the next decade, beginning in Europe this year. DSPs improve transmission quality through editing techniques such as echo cancellation, and they expand line capacity by compressing signals into one-third of their analog bandwidth;
- **Consumer products**: Along with existing markets in office equipment, CD players, and electronic games and toys, vendors gush over future opportunities in speech processing, advanced-definition television, and digital audio tape recorders. The DSP Group Inc. in San Jose, for example, recently had its chips designed into Sanyo transcription machines that replay recordings at any speed without distorting the speaker's voice.

It took a lot of investment and proselytizing by TI and others to bring the market to this point, since making DSPs is a technical challenge that requires extensive mathematical skills and expertise in both analog and digital design. TI has revolutionized the market by pioneering the use of easy-to-use PC-based development tools in the early 1980s. Since 1983, the company has also offered free training to professors, discounted software and textbooks, and sponsored classes at over 200 universities to inspire interest. "TI did the dirty work for the rest of the industry," says Strauss. "Until recently, almost all of the of the designs you saw at technical conferences came out of TI."

But rapid market growth has not meant profits for most DSP vendors, managers report. Sources say that TI has the only profitable general purpose DSP operation in the world, and the company reportedly did not turn a profit until 1987—seven years after its first product introduction.

A Japanese retreat from DSP market

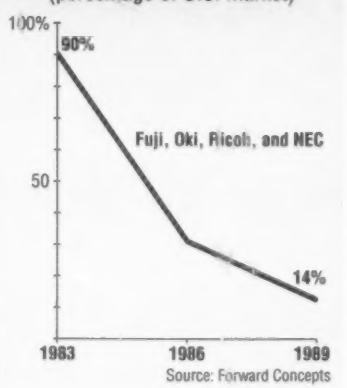
Although U.S.-based Advanced Microsystems Inc. is credited with introducing the first general-purpose digital signal processor in 1978, it was the Japanese who dominated the commercial DSP market in its early years. By 1980, NEC Corp. was offering the most reliable product on the market and the lowest prices. By 1983, NEC—along with Fujitsu Ltd., Oki Semiconductor, and Ricoh Co. Ltd.—controlled about 90% of the commercial DSP market in the United States, says market analyst Will Strauss, president of Forward Concepts in Tempe, Ariz.

Today, Fujitsu, Oki, and Ricoh have all but abandoned the U.S. market and NEC appears to be faltering. The four companies now control less than 15% of the market, says Strauss, having been burned by their own lack of customer support and competitive applications-development tools. "In Japan, customers look to the vendor for applications development," says Strauss. "But here, we want to design our own stuff, and the [Japanese companies] just don't have the support in place."

"We are not a factor in the [standard-products] marketplace," says Ron Gadway, product marketing manager for Fujitsu Microelectronics Inc. in San Jose. "Frankly, I've told top management not to market the product proactively until I can support it. There is no sense telling people to knock on the door if I have to turn them away." Fujitsu's DSP sales have fallen from around $2 million in 1988 to under $1 million this year, sources say.

Gadway and other managers of U.S. subsidiaries find themselves in no-man's land as U.S.-based market leaders such as Texas Instruments Inc. and Motorola Inc. put the squeeze on smaller DSP competitors. Management is often unresponsive to calls from their U.S. subsidiaries to send money or DSP experts based in Japan. "Since they don't set all of our budgets, we have to decide on our own priorities, and DSP is simply not worth the effort," says Gadway. "We get a lot more return on investment in other areas with a lot less manpower."

Japan's departure from general purpose DSPs



Japan's foray into the U.S. DSP market has not been a total failure. Relatively little has been spent on the ventures to date, analysts say, yet systems makers including Fujitsu, NEC, and Ricoh have improved their ability to make low-cost DSP devices for use in their own products. And all target non-programmable applications-specific DSPs called FASICs (function and algorithm-specific ICs) at high-volume customers with a need for low-priced, plug-and-play DSP modules.

"We are not getting out of the DSP market," says Jerry Gora, technical marketing manager with Oki Semiconductor. "We are just repositioning. TI may want to be everything to all people, but we are taking a rifle-shot approach to marketing, not a shotgun approach."

But others question the long-term viability of an applications-specific strategy when the price performance of programmable general-purpose chips is improving so rapidly. "The people who can use [FASICs] really love them now, but the customer base is too narrow," says Bryant Wilder, DSP operations manager for Motorola. "Sooner or later, we will take those markets as well." □

One reason for the meager returns is the sheer complexity of DSP technology itself. A DSP chip can be thought of as a microprocessor unit with a one-track mind—dedicated to rapidly executing complex DSP algorithms, often in real time. Packed with very-large-scale-integration technology, high-end DSPs can reach speeds of 275 million instructions per second. Engineers with the training to design these racehorses command salaries upwards of $50,000 right out of graduate school. "Just to compete costs tens of millions of dollars per year, and I am not even talking about fabs and corporate marketing," says Michael Hames, TI's DSP department manager in Houston. "I am just talking about new designs and tools."

TI and the competition

Despite increasing competition, TI is now in position to reap its harvest. The company already controls over 60% of the programmable market, according to Forward Concepts, and that percentage should slip only slightly as rivals try to steal market share in a growing market. TI offers 25 device types ranging from $3 to $200 each, 10,000 customers, and support from 1,000 third parties, says Hames. "And we have the highest volumes, allowing us to have a maniacal focus on reducing costs."

As a result, TI's pursuers have for the most part targeted new users of DSP technology. Here is a rundown on those vendors' efforts:

- Motorola's dominance in mobile-communications systems makes it a favorite in digital cellular-telephone and other communications markets. The company's Austin-based DSP Operations group has doubled its sales in each of the past two years, says Strauss, making it the fastest-growing competitor and the second-largest programmable DSP supplier, with a 10.2% market share;
- While AT&T is also a natural for communications, the company has had problems selling commercial semiconductors and could also be constrained by its relative lack of third-party support. Still, huge internal demand, volume contracts with such companies as Finland's Nokia Group, and the vaunted support of Bell Labs' research-and-development resources give AT&T staying power in DSP. The company plans to attack high-margin markets such as multimedia computing and office-communications equipment, says DSP applications engineer Frank Ferro;
- Analog Devices, built on decades-old expertise in mixed-signal technology, needed only three quarters to exceed its 1990 goal of acquiring more than 400 contracts. The company plans to first attack the communications markets, says DSP marketing manager Henry Davis;
- Having lost market share in recent years, NEC plans to take a higher profile to highlight the company's 10-year involvement in DSP, high-quality manufacturing, and under-publicized but substantial support programs, says NEC's DSP product line manager George Wang. Still, NEC's products are said to be hard to use and lack support from overextended third-party vendors who see NEC's DSP platform on the downturn.

These programmable standard-part DSP vendors have until now approached their market as if it were a traditional standard-parts semiconductor market: All have invested heavily in R&D and manufacturing in an effort to drive down prices, enlarge demand, and limit competition. But as with the microprocessor markets in the 1970s and 1980s, the key to market growth lies in software.

"We have learned from the PC industry that applications won't come out of the woodwork until there are software standards," says *Spectron*'s Wong, who has so far drawn the support of TI, Motorola, and Analog Devices for his company's SPOX DSP operating system. While DSP vendors want to expand the size of the pie, he says, "the bottleneck is the applications software."

For now, the relative lack of commercial software is giving suppliers of product-specific non-programmable devices an advantage with customers who don't want to do their own applications programming. An example is Zoran Corp., which became profitable after seven years by locking up a number of undisclosed deals with major Japanese systems manufacturers. "The high-volume guys want canned solutions," says Levy Gerzberg, Zoran's president. "They need inexpensive, highly-integrated solutions with short development cycles, and they don't want to write code."

"Your average systems designer has no DSP experience," says Geoff Philips, director of DSP product marketing at Harris Semiconductor in Melbourne, Fla., which has been moving into the FASIC market since 1987. "But his company probably wants to move into it very fast, so he has to train himself and use inefficient commercial software aids to get the job done. We want to give him a black box that has all that knowledge embedded inside."

Other observers find long-term chinks in this FASIC strategy. "As time goes on, reprogrammable devices will become a more effective solution," according to analyst Andrew Rappaport, president of Boston-based Technology Research Group. "As the price of standard products comes down and the quality of development software goes up, there is less reason to go to an application-specific solution." □

FDDI comes on strong as networks run out of room

Market heats up as computer-systems vendors join the ranks of suppliers offering fiber-optic products

BY DWIGHT B. DAVIS

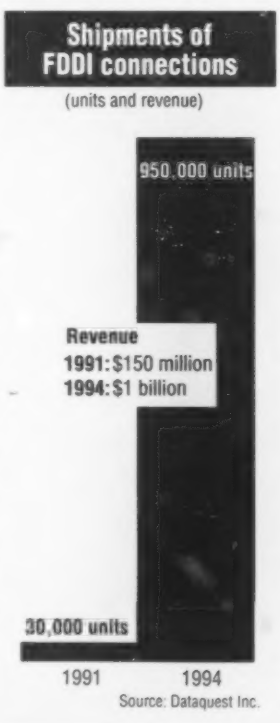
Local area networks, as pervasive as they have become, share a history of false starts and exaggerated market projections. During the early to mid-1980s, increasingly nervous LAN vendors proclaimed one year after the next "the year of the LAN." Users, however, took their time warming up to local networking.

But warm up they finally did, and today LANs are an indispensable element of corporate-information operations. The circumscribed networks have become so popular, in fact, that many are overloaded with users and traffic. The result has been an environment in which an emerging, fiber-optic-based LAN technology—the Fiber Distributed-Data Interface, or FDDI—may actually keep pace with analysts' optimistic growth predictions.

Among those forecasts is a Dataquest Inc. estimate that predicts the number of FDDI connections will grow from about 30,000 units shipped this year to 950,000 by 1994, with revenue from these shipments projected to grow from $150 million to $1.3 billion during that same period.

A spectrum of vendors has coalesced to provide FDDI products. They include semiconductor companies manufacturing chip sets based on the FDDI standard, and communications equipment companies that use the chips to build various networking products. Joining the FDDI ranks in 1990 with products of their own were several systems companies, including Digital Equipment Corp. (Maynard, Mass.) and Sun Microsystems Inc. (Mountain View, Calif.).

Operating at 100 megabits per second (Mbps), FDDI can serve as a "backbone," linking slower-speed LANs such as Ethernet (10 Mbps) and token-ring (4 Mbps or 16 Mbps) networks. FDDI can also run as a LAN itself, although bringing its fiber-optic connections directly to users' desks is still too costly for all but the most demanding applications. Sun's FDDI controller, for example, lists for $12,500.



Others cost much less. With discounts, the average selling price for FDDI connections is now about $6,500, says Marty Palka, Dataquest's senior industry analyst for networks. At first, pre-chip-set FDDI connections cost three times that or more; further, chip development will keep prices heading southward.

Advanced Micro Devices Inc. in Sunnyvale, Calif., hit the market first with an FDDI chip set—the Supernet 1—in 1988. The five-chip Supernet 1 initially cost $590 in quantities of 1,000; it now sells for $295 in the same quantity and has won more than 150 design-ins worldwide, says Basil Alwan, FDDI product marketing manager at AMD.

This month, AMD is scheduled to begin shipments of its second-generation FDDI chip set, the Supernet 2. With more features, lower power and space requirements, and a price of $225 in 1,000-unit quantities, Alwan estimates that the new product may cut the end-user price of a single attachment FDDI station by $1,000.

AMD is not alone in offering the FDDI standard in silicon. National Semiconductor Corp. in Santa Clara, Calif., introduced its own five-chip FDDI solution last April and is currently developing a two-chip second-generation product. Digital Equipment also designed FDDI chips early on and has licensed their manufacture to AMD and Motorola. Both companies are already supplying Digital with chips, and each has the option to offer the components on the open market as well.

Making FDDI affordable

The long-term goal of the chip developers and their OEM customers is to bring down the cost of FDDI connections to a much more affordable level. "We need to get to the $1,000 to $1,500 level by 1993 if we are going to meet the market projections," says Karen Parker, FDDI applications manager at National Semiconductor.

Reaching this pricing goal could prove difficult, since a large percentage of a connector's cost falls outside the realm of the FDDI chip sets. As much as one-third of the cost can be tied to the components that provide the fiber-optic linkage. The circuitry that interfaces the controller to the

networked system can account for another third.

Most of the current FDDI product marketing centers on higher-level concentrators, bridges, and routers rather than on individual workstation controllers. Because these other devices support entire networks of users, or link different types of networks together, the high costs of FDDI can be better amortized.

Proteon Inc. in Westborough, Mass., for example, sells a router designed to interconnect different types of LANs to one another as well as to the outside public network. The product, the P4200 router, sells for $12,000-$15,000 without its FDDI option, and for $25,000-$27,000 with it, says Nate Kalowski, vice president of marketing.

Big LAN on campus

FDDI bridges and routers such as the P4200 are, for the most part, being purchased for "campus" networking applications. In these, the FDDI network serves as a backbone superhighway linking Ethernet and token-ring LANs within a single building or among a group of buildings. Internetworking vendor Cisco Systems Inc. in Menlo Park, Calif., has sold more than 350 FDDI routers, with the vast majority serving in such campus backbone configurations, says Brent Bilger, FDDI product manager.

Like routers and bridges, concentrators can connect directly to the FDDI backbone, but they can also function as central hubs that support a number of LAN spokes. Some intelligent concentrators support multiple types of LAN spokes and, as such, permit users to grow gradually into FDDI as their networking needs expand.

Digital Equipment, for one, sells a hierarchy of FDDI products that permit users to migrate into the FDDI environment. Existing Ethernet LANs can connect to the DECbridge 500, a $25,000 device that translates between Ethernet and FDDI protocols. The bridge, in turn, is connected to a DECconcentrator 500, which links directly to the FDDI backbone network.

Connecting individual FDDI users to the FDDI backbone through a concentrator has the advantage of isolating the main FDDI backbone from disruption should a workstation malfunction, says Karl Pieper, FDDI product development marketing manager at Digital Equipment.

With the growing influx of FDDI products, ensuring that different vendors' devices work with one another has become an industry priority. Different implementations of the FDDI specifications—even products based on the same chip sets—can meet the standard but still fail to interoperate.

Most vendors conduct their own in-house testing between their products and those of other suppliers. In addition, AMD and the University of New Hampshire each run interoperability testing laboratories to determine if products meet the basic FDDI standard and if they can communicate with other FDDI products.

Many compatibility problems center on a portion of the standard called Station Management (SMT), the only part of the FDDI which is not yet ratified. SMT has gone through several revisions as part of the standard-development process, with the most recent version designated as SMT revision 6.2.

A hurdle to SMT's ratification is backward-compatibility with earlier versions, says R. Bruce McClure, chairman of Synernetics Inc. in North Billerica, Mass. Synernetics licenses its SMT software implementation to companies unwilling or unable to develop their own and also sells FDDI hardware products. If the final SMT version is forced to be backward-compatible, the specification's features may be unduly constrained, McClure believes. Those vendors that have installed FDDI products based on the earlier SMT specs argue that the final version can't abandon present users.

The resolution of the SMT problem remains uncertain, but few think that it threatens the widespread acceptance of FDDI.

"The systems vendors definitely legitimize the market," says AMD's Alwan. "Up to now, we have had to push FDDI into the marketplace. Now, user demand is starting to pull vendors into the market." □

Fiber and copper promise cheaper FDDI

The high cost of fiber distributed-data interface prompts suppliers to search for low-cost implementations of the standard. Two working groups within the American National Standards Institute (ANSI) committee responsible for FDDI are taking different paths toward that end.

One group hopes to develop a less-expensive version of the standard by specifying lower-power optical components. This version would still operate over fiber-optic cable, but the distance a signal could travel would be limited to about 300 feet.

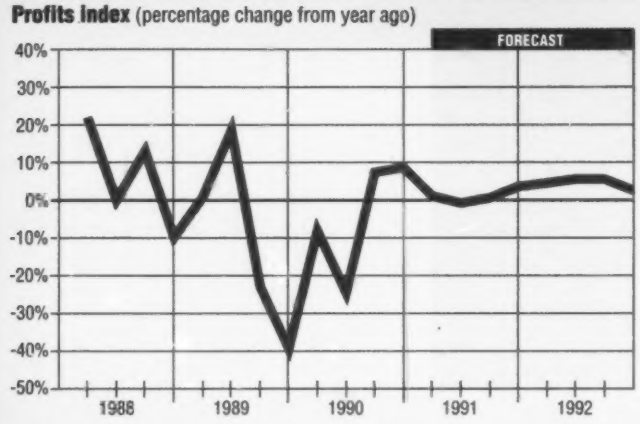
The second working group's goals are more radical: They hope to operate FDDI over twisted-pair copper cabling, thereby eliminating the cost of optical components altogether. Many observers once doubted that twisted-pair wiring could support 10-megabit-per-second Ethernet speeds, much less FDDI's 100 Mbps. Several vendors claim to have successfully tested copper implementations of FDDI, however, and a number are developing twisted-pair products.

The ANSI working groups hope to have their respective proposals on their way to ratification by December 1992, according to R. Bruce McClure, chairman of Synernetics Inc., who chairs the low-cost fiber implementation working group. He and others worry that the marketplace could become confused if too many proprietary solutions appear before the standards evolve. Steve Bell, manager of the LAN Business Development Group at National Semiconductor, acknowledges this concern but says, "We are tracking the standard as closely as possible in our [joint] development program with Cabletron Systems."

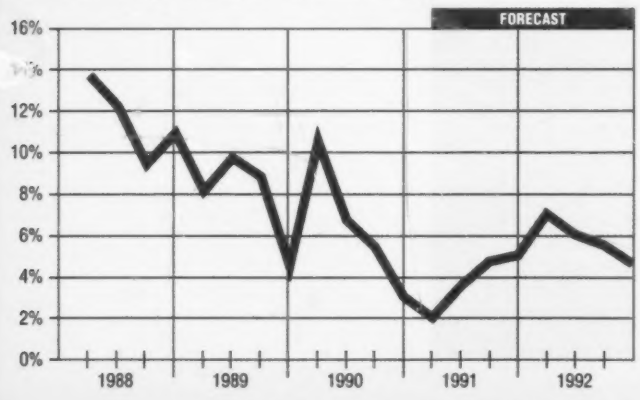
Another wild card in the push for low-cost FDDI solutions is the ongoing price drop for standard fiber-optic components. "If the price for electro-optical converters drops appreciably in the coming years, it will lessen the demand for alternative fiber-optic and twisted-pair solutions for FDDI," says Karl Pieper, FDDI product development marketing manager at Digital Equipment Corp. □

ELECTRONIC BUSINESS indexes

Profits index (percentage change from year ago)



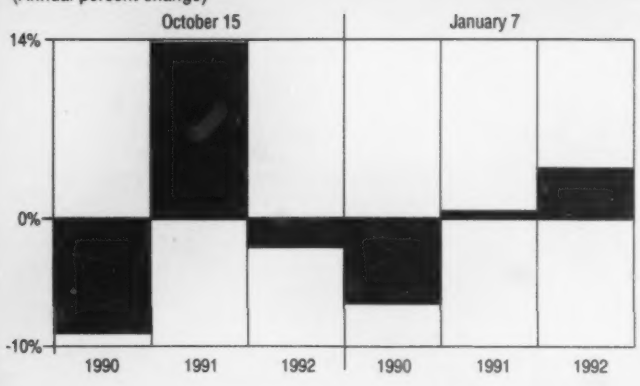
Revenue index (percentage change from year ago)



Data source: ELECTRONIC BUSINESS; Forecast: Cahners Economics

A look at the revised profits forecast

(Annual percent change)



Brush with recession repaints profit picture

Despite all the recent bad economic news, electronics industry profits performed better than expected in the third quarter of 1990. According to the ELECTRONIC BUSINESS profits index—a tally of 17 representative electronics companies' balance sheets—profits rose 6.8% last summer from year ago levels. ELECTRONIC BUSINESS economists had predicted that profits growth would be steady. All in all, this was a sharp turnaround from the 25% year-ago decline in profits that occurred in the spring. Assuming the final quarter of 1990 stays on track, we expect the final damage in 1990 profits to be a 7% loss from 1989 levels.

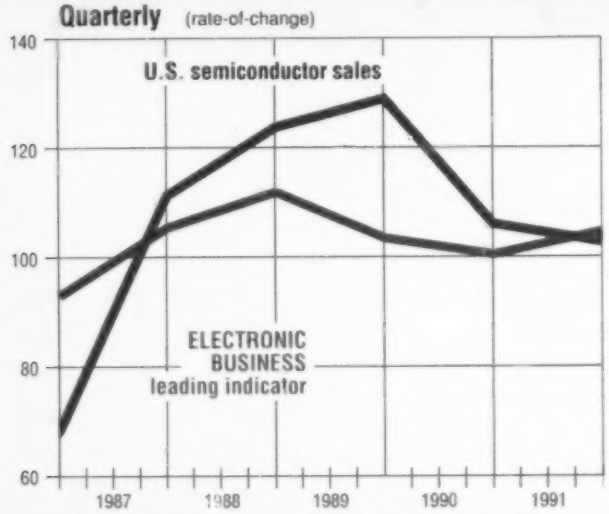
The question continues to loom: Will profits be eaten away in 1991 by the recession-threatening events of the past few months? Three months ago this forecaster was adamant that electronics industry profits could and would rebound with 14% growth in 1991. Alas, continued uncertainty about the impact of the Persian Gulf crisis in the final months of last year has had a worse effect on the economy than had been predicted. The recession could still be averted, but the odds of rapid, solid economic growth in early 1991 have become extremely slim.

Instead the ELECTRONIC BUSINESS economic scenario now calls for only a 0.6% increase in electronics profits next year. The reason the profits forecast has been downgraded has everything to do with business and consumer confidence. The recovery that had clearly begun for electronics distributors and semiconductor manufacturers is being short-circuited by a lack of confidence and the subsequent cutback in spending. It appears now that all the cost controls in the world will not help profits growth hit the double digits.

However, the weakness in profits that is now expected in 1991 means 1992 profits will be better than previously expected. The bite we will see this year will be healed in 1992 as sales once again rebound following the long 1990-1991 hiatus. So electronics profits have been revised upward to 4% growth in 1992.

ELIZABETH B. BAATZ

ELECTRONIC BUSINESS Leading Indicator



To obtain a complimentary copy of a 12-page backround paper on the ELECTRONIC BUSINESS Leading Indicator, please contact Linda Keehn, Cahners Economics, Cahners Publishing Co., 275 Washington St., Newton, MA 02158-1630 USA, telephone (617) 630-2119, fax (617) 630-2100.

The ELECTRONIC BUSINESS Leading Indicator (EBLI) dropped a point to 99.1 in October. We had been forecasting EBLI would be showing a definite slow-growth expansion by this time, but instead the past three months have shown no increase. The holding pattern of EBLI does not indicate a significant cyclical rebound for electronics in 1991. Nor, however, does it indicate a recession. We now expect EBLI to peak at a modest 111.1 level in August of 1991 (compared to 114 in June 1991 that we had forecast three months ago). The mild rebound will be even milder than our first predictions.

Source: Cahners Economics

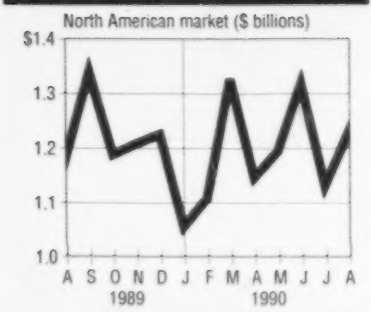
Electronics industry indicators this month

	Latest month	Previous month	Year ago	1989 average
ELECTRONIC BUSINESS Leading Indicator (rate-of-change, Oct.)	99.07	101.03	97.05	100.9
U.S. semiconductor bookings ($ millions, 3-month average, Oct.)	$1,198	$1,214	$1,109	$1,205
Weekly hours of semiconductor production workers (monthly average, Oct.)	40.8	39.4	40.5	40.1
Electronics components lead time index (1977 = 100, Nov.)	80.5	64.0	94.2	102.5
S&P's semiconductor stock price index (1970 =10, monthly average, Oct.)	52.0	56.7	58.7	54.7
Change in electronics components inventories ($ millions, SA, Sept.)	+$55	-$186	-$123	-$12.8
Contracts and orders for plant and equipment ($ billions, SA, Sept.)	$42.2	$39.4	$41.6	$43.4

SA = seasonally adjusted, all other data are not seasonally adjusted

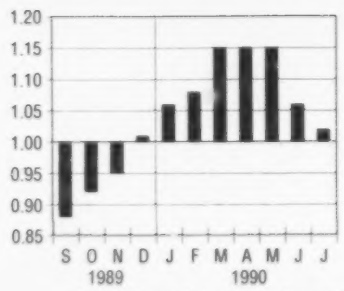
Sources: Semiconductor Industry Association, U.S. Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, U.S. Department of Commerce, U.S. Bureau of Economic Analysis

Semiconductor sales



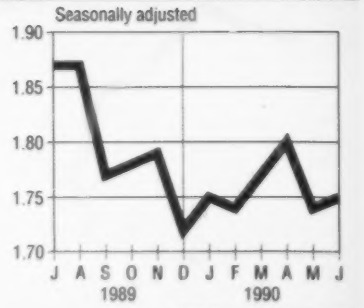
Source: Semiconductor Industry Association

Semiconductor book-to-bill ratio



Source: Semiconductor Industry Association

Component inventory-to-shipment



Source: U.S. Commerce Department